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(54) CLEANING CONTROLLER, INK JET PRINTER, ITS CONTROLLING
METHOD AND INFORMATION RECORDING MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an ink jet printer in which clogging of an ink nozzle is detected at an appropriate time and recovery processing of a print head can be carried out efficiently depending on the detection results.

SOLUTION: The cleaning controller 30 comprises a mechanism 40 for cleaning the nozzles of a print head 12, a mechanism 50 for detecting the ink state for the nozzles of a print head 12, and a control section 60 having a function 64 for making a decision whether the nozzle detection mechanism 50 is operated or not based on a specified criterion, a function 65 for operating the nozzle detection mechanism 50 based on the decision results, a function 66 for making a decision whether the cleaning mechanism 40 is operated or not based on the results obtained by the nozzle detection mechanism 50, and a function 67 for operating the cleaning mechanism 40 based on the decision results obtained by the cleaning decision function 66.

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CLAIMS

[Claim(s)]

[Claim 1] The print head which has the nozzle side where the nozzle in which the regurgitation [a liquid ink drop] is possible was arranged, The cleaning device for cleaning the inside of the nozzle of said print head, or a nozzle side, The nozzle detection device for detecting an ink condition about the inside of the nozzle of said print head, or a nozzle side, The nozzle detection judgment function which judges whether said nozzle detection device is operated based on a predetermined criterion, The nozzle detection processing facility which operates said nozzle detection device based on the decision result of the nozzle detection judgment function concerned, The cleaning judgment function which judges whether said cleaning device is operated based on the detection result of said nozzle detection device, The cleaning control unit characterized by having the control section which has the cleaning treatment function to operate said cleaning device based on the decision result of the cleaning judgment function concerned.

[Claim 2] It is the cleaning control unit according to claim 1 which said control section is equipped with the memory which stored said decision criterion defined about the elapsed time from an initiation [of the predetermined processing supposed that cleaning is required], or termination point in time, and the timer which measures the elapsed time from an initiation [of predetermined processing], or termination point in time, and is characterized by for said nozzle detection judgment function to operate said nozzle detection device when the elapsed time measured by said timer is over said decision criterion.

[Claim 3] Said timer is a cleaning control unit according to claim 2 characterized by measuring the elapsed time from the last nozzle detection processing.

[Claim 4] Said timer is a cleaning control unit according to claim 2 characterized by measuring the elapsed time from the last cleaning treatment.

[Claim 5] Said timer is a cleaning control unit according to claim 2 characterized by measuring the elapsed time from the termination point in time of the last printing processing.

[Claim 6] Said timer is a cleaning control unit according to claim 2 characterized by measuring the elapsed time after said nozzle side of said print head is covered with a head cap.

[Claim 7] Said timer is a cleaning control unit according to claim 2 characterized by measuring the accumulation time amount in the condition of having exposed without covering the processing time about the processing to which said print head carries out the regurgitation of the liquid ink drop, or said nozzle side of said print head with a head cap.

[Claim 8] Said decision criterion is claim 2 characterized by what is defined corresponding to temperature and humidity thru/or the cleaning control unit of seven given in any 1 term.

[Claim 9] The memory which stored said decision criterion defined about the number of use of said print head from an initiation [of the predetermined processing supposed that said control section requires cleaning], or termination point in time, It has the counter which carries out counting of the number of use of said print head from an initiation [of predetermined processing], or termination point in time. Said nozzle detection judgment function The cleaning device according to claim 1 characterized by operating said nozzle detection device when the number of use by which counting was carried out with said counter is over said decision criterion.

[Claim 10] Said counter is a cleaning control unit according to claim 9 characterized by carrying out counting of the number of use of said print head from the last nozzle detection processing.

[Claim 11] Said counter is a cleaning control unit according to claim 9 characterized by carrying out counting of the number of use of said print head from the last cleaning treatment.

[Claim 12] Said decision criterion is claim 9 characterized by what is defined corresponding to temperature and humidity thru/or the cleaning control unit of 11 given in any 1 term.

[Claim 13] Said control section is claim 1 characterized by repeating and performing nozzle detection processing by said nozzle detection processing facility, and cleaning treatment by said cleaning treatment function until the decision result of the purport that cleaning is unnecessary is obtained from said cleaning judgment function thru/or the cleaning control unit of 12 given in any 1 term.

[Claim 14] In the ink jet printer which has the print head equipped with the nozzle forming face in which two or more ink nozzles were formed, and prints by breathing out a liquid ink drop from said ink nozzle A regurgitation detection means to detect the discharge condition of the liquid ink drop from said ink nozzle, The 1st decision means which judges whether said regurgitation detection means detects the discharge condition of said liquid ink drop based on the decision criterion beforehand defined according to actuation of said printer, The ink jet printer characterized by having the 1st control means which said regurgitation detection means is controlled [control means] and makes the discharge condition of said liquid ink drop detect based on the decision result of said 1st decision means.

[Claim 15] The ink jet printer according to claim 14 characterized by to have the recovery means for maintaining or recovering the engine performance of said print head, the 2nd decision means which judges whether recovery of said print head carries out with said recovery means based on the result of the regurgitation detection by said regurgitation detection means, and the 2nd control means which control said recovery means based on the decision result of said 2nd decision means, and perform the recovery of said print head.

[Claim 16] the time check which measures the elapsed time from an initiation [of predetermined processing of said ink jet printer], or termination point in time -- a means -- having -- said 1st decision means -- said time check -- the ink jet printer according to claim 14 characterized by judging whether the discharge condition of said liquid ink drop by said regurgitation detection means is detected by comparing with said decision criterion said elapsed time clocked by the means.

[Claim 17] counting which carries out counting of the number of use of said print head from an initiation [of predetermined processing of said ink jet printer], or termination point in time -- a means -- having -- said 1st decision means -- said counting -- the ink jet printer according to claim 14 characterized by to judge whether the discharge condition of said liquid-ink drop by said regurgitation detection means is detected by comparing the number of use and said decision criterion of said print head by which counting was carried out with the means.

[Claim 18] In the approach of controlling the ink jet printer which has the print head equipped with the nozzle forming face in which two or more ink nozzles were formed,

and prints by breathing out a liquid ink drop from said ink nozzle The regurgitation detection step which detects the discharge condition of the liquid ink drop from said ink nozzle, The 1st decision step which judges whether the discharge condition of said liquid ink drop by said regurgitation detection step is detected based on the decision criterion beforehand defined according to actuation of said printer, The control approach of the ink jet printer characterized by having the 1st control step which makes the discharge condition of said liquid ink drop detect based on the decision result of said 1st decision step.

[Claim 19] The control approach of the ink jet printer according to claim 18 characterized by to have the recovery step for maintaining or recovering the engine performance of said print head, the 2nd decision step which judges whether recovery of said print head is carried out based on the result of the regurgitation detection by said regurgitation detection step, and the 2nd control step which performs recovery of said print head based on the decision result of said 2nd decision step.

[Claim 20] the time check which measures the elapsed time from an initiation [of predetermined processing of said ink jet printer], or termination point in time -- a step -- having -- said 1st decision step -- said time check -- the control approach of the ink jet printer according to claim 18 characterized by judging whether the discharge condition of said liquid ink drop by said regurgitation detection step is detected by comparing with said decision criterion said elapsed time clocked in the step.

[Claim 21] counting which carries out counting of the number of use of said print head from an initiation [of predetermined processing of said ink jet printer], or termination point in time -- a step -- having -- said 1st decision step -- said counting -- the control approach of the ink jet printer according to claim 18 characterized by to judge whether the discharge condition of said liquid-ink drop by said regurgitation detection step is detected by comparing the number of use and said decision criterion of said print head by which counting was carried out in the step.

[Claim 22] The information record medium which recorded the program which realizes each step of the control approach of the ink jet printer of a publication on any 1 term of claims 18-21.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to blinding detection and its recovery technique of the ink nozzle in an ink jet printer.

[0002]

[Description of the Prior Art] An ink jet printer forms desired printing on print media by carrying out the regurgitation of the liquid ink drop from the ink nozzle of a print head. When the condition that a liquid ink drop is not breathed out from an ink nozzle continues beyond fixed time amount, even if the moisture which is the solvent of ink evaporates and the viscosity of the ink near the ink nozzle increases, as a result a lifting and a liquid ink drop are not breathed out for an ink nozzle in blinding or it is breathed out, not a liquid ink drop but poor printing of original magnitude or speed may occur (a dot omission is called hereafter). Moreover, for example, when both-way migration of a print head is repeatedly performed depending on the busy condition of a print head, the ink meniscus of each ink nozzle may break, consequently a dot omission may arise.

[0003] For this reason, in order to maintain or recover the printing engine performance, he covers an ink nozzle with a cap and is trying to prevent the increment in ink viscosity in an ink jet printer. Moreover, he is trying to discharge thickening ink and air bubbles outside by driving the auxiliary discharge appearance and the ink suction pump which carry out the regurgitation of the liquid ink drop from all ink nozzles periodically, and attracting the ink in a print head. Furthermore, he is trying to wipe off foreign matters adhering to the nozzle forming face of a print head, such as paper powder and ink, with an elastic blade.

[0004] The recoveries (it is also called cleaning) of such a print head are a power up, the printing initiation time, etc., and when predetermined time amount has passed since the last recovery, they are performed. Moreover, it is carried out, also when it points so that recovery may be performed from an operator.

[0005]

[Problem(s) to be Solved by the Invention] However, in the conventional ink jet printer, recovery of a print head was compulsorily performed after predetermined period progress irrespective of whether thickening ink is carrying out blinding to the ink nozzle of a print head, or the meniscus in an ink nozzle has broken. That is, in order to maintain a quality of printed character, before blinding etc. may happen, it is made to perform recovery with allowances. And there was a problem that this led to waste of ink or delay of printing processing.

[0006] The purpose of this invention is to offer the ink jet printer which can perform recovery of a print head efficiently according to the detection result while detecting the blinding of an ink nozzle to timely.

[0007]

[Means for Solving the Problem] This invention made in order to attain the above-mentioned purpose The print head which has the nozzle side where the nozzle in which the regurgitation [a liquid ink drop] is possible was arranged, The cleaning device for cleaning the inside of the nozzle of a print head, or a nozzle side, The nozzle detection device for detecting an ink condition about the inside of the nozzle of a print head, or a nozzle side, The nozzle detection judgment function which judges whether a

nozzle detection device is operated based on a predetermined criterion, The nozzle detection processing facility which operates a nozzle detection device based on the decision result, The cleaning judgment function which judges whether a cleaning device is operated based on the result obtained according to the nozzle detection device, It is the cleaning control unit characterized by having the control section which has the cleaning treatment function to operate a cleaning device based on the decision result obtained by the cleaning judgment function.

[0008] a ***** [that there is a dot omission within a nozzle about the ink condition of a print head according to this invention] -- or after detecting whether ink has adhered around a nozzle on a nozzle side, since it is not necessary by being made to clean to clean when the ink condition of a print head is normal, ink or time amount which cleaning takes cannot be consumed vainly, but it can clean efficiently.

[0009] A control section is equipped with the memory which stored the decision criterion defined about the elapsed time from an initiation [of the predetermined processing supposed that cleaning is required], or termination point in time, and the timer which measures the elapsed time from an initiation [of predetermined processing], or termination point in time in this invention, and when the elapsed time measured by the timer is over the decision criterion, as for a nozzle detection judgment function, it is desirable to operate a nozzle detection device. An ink condition is detectable to the optimal timing assumed to become a dot omission by this.

[0010] this invention -- setting -- a timer -- the last nozzle detection processing -- since -- measuring elapsed time -- The elapsed time from the termination point in time of the last printing processing is measured [measuring the elapsed time from the last cleaning treatment,], The elapsed time after the nozzle side of a print head is covered with a head cap is measured, The processing time about the processing to which a print head carries out the regurgitation of the liquid ink drop, or the nozzle side of a print head should just measure the accumulation time amount in the condition of breathing out without being covered with a head cap. Thereby, the optimal timing can be set up according to the operating condition of a printer.

[0011] As for a decision criterion, in this invention, being set corresponding to temperature and humidity is also effective. Thereby, according to an environmental variation, an ink condition is detectable to the optimal timing.

[0012] It has the counter which carries out counting of the number of use of the print head from an initiation [of predetermined processing], or termination point in time to the memory which stored the decision criterion defined about the number of use of the print head from an initiation [of the predetermined processing supposed that a control section requires cleaning in this invention], or termination point in time, and when the number of use by which counting was carried out with the counter has exceeded the decision criterion, it is [judgment function / nozzle detection] desirable in operating a nozzle detection device. Thereby, even if it is under a different operating condition, an

ink condition is detectable to the optimal timing assumed to become a dot omission.

[0013] In this invention, a counter should just be made to carry out counting of the number of use of the print head from carrying out counting of the number of use of the print head from the last nozzle detection processing, and the last cleaning treatment.

[0014] As for a decision criterion, in this invention, being set corresponding to temperature and humidity is also effective. Thereby, according to an environmental variation, an ink condition is detectable to the optimal timing.

[0015] In this invention, as for a control section, it is desirable to repeat and perform nozzle detection processing by the nozzle detection processing facility and cleaning treatment by the cleaning treatment function until the decision result of the purport that cleaning is unnecessary is obtained from a cleaning judgment function. Thereby, a quality of printed character is certainly maintainable.

[0016] Moreover, the ink jet printer of this invention has the print head equipped with the nozzle forming face in which two or more ink nozzles were formed, and sets it to the ink jet printer which prints by breathing out a liquid ink drop from said ink nozzle. A regurgitation detection means to detect the discharge condition of the liquid ink drop from said ink nozzle, The 1st decision means which judges whether said regurgitation detection means detects the discharge condition of said liquid ink drop based on the decision criterion beforehand defined according to actuation of said printer, It is characterized by having the 1st control means which said regurgitation detection means is controlled [control means] and makes the discharge condition of said liquid ink drop detect based on the decision result of said 1st decision means. Thereby, the blinding of the ink nozzle of the print head is detectable to timely.

[0017] Moreover, it is characterized by to have the recovery means for maintaining or recovering the engine performance of said print head, the 2nd decision means which judges whether recovery of said print head carries out with said recovery means based on the result of the regurgitation detection by said regurgitation detection means, and the 2nd control means which controls said recovery means based on the decision result of said 2nd decision means, and perform the recovery of said print head. Thereby, according to the result of blinding detection of an ink nozzle, recovery of the print head can be performed efficiently.

[0018] in this case, the time check which measures the elapsed time from an initiation [of predetermined processing of said ink jet printer], or termination point in time -- a means -- having -- said 1st decision means -- said time check -- it is desirable to judge whether the discharge condition of said liquid ink drop by said regurgitation detection means is detected by comparing with said decision criterion said elapsed time clocked by the means.

[0019] moreover, counting which carries out counting of the number of use of said print head from an initiation [of predetermined processing of said ink jet printer], or termination point in time -- a means -- having -- said 1st decision means -- said counting

-- it is desirable to judge whether the discharge condition of said liquid ink drop by said regurgitation detection means is detected by comparing the number of use and said decision criterion of said print head by which counting was carried out with the means.

[0020] Moreover, it is appropriate for this invention to grasp also as the control approach of an ink jet printer, and it does the same operation and effectiveness so also in such a case. Moreover, the control approach of an ink jet printer can be supplied as a control program which can be performed by the control section, and can be offered through the record medium which recorded the control program.

[0021]

[Embodiment of the Invention] Hereafter, the gestalt of desirable operation of this invention is explained to a detail with reference to a drawing.

[0022] Drawing 1 is drawing showing the outline configuration of the printer of the gestalt of this operation. The printer 1 is equipped with the print head device 10, the cartridge device 20, and the cleaning control unit 30 as shown in drawing 1.

[0023] It has the print head 12 supported by the carriage shaft 11 movable, and the power from the drive motor which is not illustrated is transmitted to this print head 12 through a gearing etc., and the print head device 10 is constituted so that it can move in a predetermined printing field. Moreover, the nozzle side 14 where two or more arrays of the nozzle 13 in which the regurgitation [a liquid ink drop] is possible were carried out is formed in the print head 12. Storage of the ink of the specified quantity is possible in the interior of a print head 12, and each nozzle 13 and the control room 14 which was open for free passage are established in it. By impressing a predetermined electrical potential difference, this control room 14 extrudes some ink in which the meniscus was formed within each nozzle 13, and it is constituted so that it may inject from a nozzle 13 as a liquid ink drop.

[0024] The cartridge device 20 holds the ink cartridge 23 which has the ink supply pack 21 and the ink abandonment pack 22 removable, and it is constituted so that the ink contained in the ink supply pack 21 may be supplied to a print head 12 through a tube 24.

[0025] The cleaning control unit 30 consists of the cleaning device 40, a nozzle detection device 50, and a control section 60. The cleaning device 40 has the head cap 41 prepared outside the printing area. The location of this head cap 41 is also a position in readiness of a print head 12, and it is standing by until a print head 12 has a printing command, where the nozzle side 14 is covered with the head cap 41 (capping). Since auxiliary discharge appearance (Flushing) which performs the regurgitation of a liquid ink drop from all the nozzles 13 of a print head 12 in this head cap 41 is performed, the head cap 41 has the configuration which can receive the breathed-out liquid ink drop. moreover, by actuation of the ink pump 42, the ink on cap 41 and the ink in a print head 12 are attracted through the head cap 41 and a tube 43, and it collects in the ink abandonment pack 22 in an ink cartridge 23 -- it is like (ink suction actuation).

[0026] The cleaning device 40 has the cleaning lever 44 prepared outside the printing area again. this cleaning lever 44 is constituted movable by the location which projects from a flat surface including the nozzle side 14 of a print head 12 by actuation of the cleaning motor 45, and wipes away the nozzle side 14 with migration of a print head 12 -- it is like (wiping).

[0027] The nozzle detection device 50 has the micro sensor 51 arranged in the head cap 41 with magnitude comparable as the nozzle side 14. When this micro sensor 51 changes into output voltage a contact condition with the liquid ink drop breathed out from each nozzle 13, respectively destruction of the blinding in the thickening ink of each nozzle 13 or a meniscus is detected -- it is constituted like (dot omission detection or nozzle detection is called hereafter).

[0028] In addition, for a certain reason, although this nozzle detection device 50 is constituted from a viewpoint which detects the ink condition in a nozzle 13, it may also constitute it that the ink which is on the nozzle side 14 and adhered to the circumference part of a nozzle 13 has a bad influence on the discharge direction of a liquid ink drop so that the ink condition on the nozzle side 14 may be detected with the ink condition in a nozzle 13. For example, if it is when it is arranged in the location which set a certain amount of spacing from the nozzle side 14 so that the liquid-ink drop breathed out from each nozzle 13 may be contacted, and detecting the ink condition on the nozzle side 14 as it mentioned above, if it was when the ink condition in a nozzle 13 was detected, such an ink detection device 50 is constituted so that it may be arranged in the location which contacts the nozzle side 14 and directly.

[0029] Drawing 2 is the block diagram showing the control system of a printer 1. A control section 60 is for controlling cleaning, and it connects with the print head 12 and the cartridge device 20 electrically, and also it is electrically connected with the ink pump 42 and the cleaning motor 45 with micro sensor 51 temperature and a humidity sensor 68 among the nozzle detection devices 50 among the cleaning devices 40 again.

[0030] And a control section 60 has memory 61, a timer 62, and a counter 63, and the nozzle detection judgment function 64 as shown below, the nozzle detection processing facility 65, the cleaning judgment function 66, and the cleaning treatment device 67 are constituted so that it may be demonstrated, respectively.

[0031] The nozzle detection judgment function 64 is constituted so that it may judge whether the nozzle detection device 50 is operated based on the decision table memorized by memory 61. An example of a decision table is shown in drawing 3 . Especially decision table 61A used for the gestalt of this operation is referred to in case the blinding in thickening ink is detected among dot omissions. Under the environment where temperature differs from humidity, a difference is in transition change of ink viscosity. For example, it is easy to increase the viscosity of ink that the moisture contained in ink under the environment of high temperature and low humidity tends to evaporate. The judgment time amount t_0 which serves as a criterion at the time of

judging whether dot omission detection is performed from a viewpoint which copes with the blinding in such thickening ink quickly is set up in the shape of a matrix corresponding to temperature T1-T5 and humidity H1-H5. for example, the judgment time amount t0 -- low temperature -- it sets up in 2 hours in the bottom [being highly humid ($T1 < 0$ degree C, $80\% \leq H5$)] -- having -- an elevated temperature -- it is set up in 0.3 hours in the bottom [being damp ($45 \text{ degree-C} \leq T5$, $H1 < 20\%$)].

[0032] And when the elapsed time t1 measured by the timer 62 with predetermined processing of a printer 1 as the starting point is compared with the judgment time amount t0 stored in decision table 61A and elapsed time t1 is over the judgment time amount t0, the nozzle detection judgment function 64 sets a dot omission detection demand flag, and displays the purport which needs dot omission detection. A timer 62 The elapsed time from an initiation [of predetermined processing], or termination point in time For example, elapsed time from the nozzle detection processing performed to (1) last time, elapsed time from the cleaning treatment performed to (2) last time, (3) Elapsed time from the printing processing (at the printing termination time) performed to last time, elapsed time after capping of the (4) print heads is carried out (continuation quiescent time), (5) The printing processing time or the accumulation time amount of the open condition from the head cap 41 of the nozzle side 14 is measurable as elapsed time t1. And the elapsed time of at least 1 chosen as arbitration among these is used as a candidate for a comparison of the judgment time amount t0.

[0033] After making the head cap 41 carry out opposite arrangement of the print head 12 based on the condition of a dot omission detection demand flag of expressing the decision result of the nozzle detection judgment function 64, the nozzle detection processing facility 65 makes a liquid ink drop breathe out on the micro sensor 51 from each nozzle 13, and it is constituted so that the output voltage about each nozzle 13 may be sent separately.

[0034] When it judges that the cleaning device 40 is operated when there is at least one unusual output voltage among the output voltage based on the output voltage emitted from the nozzle detection processing facility 65 (i.e., when at least one Dot omission has arisen) and there are no abnormalities in output voltage, the cleaning judgment function 66 is constituted so that it may judge that the cleaning device 40 is not operated.

[0035] After making the head cap 41 carry out opposite arrangement of the print head 12 based on the decision result of the cleaning judgment function 66, the cleaning treatment function 67 is constituted by the cleaning device 40 so that cleaning treatment, such as Flushing or wiping, may be performed.

[0036] Drawing 4 is a flow chart which shows the flow of nozzle detection processing and cleaning treatment. A control section 60 compares the elapsed time t1 measured with the timer 61 with the judgment time amount t0 chosen from decision table 61A by the nozzle detection judgment function 64, and dot omission detection judges whether it is the need (step 1). When elapsed time t1 is over the judgment time amount t0, it

progresses to (step 1:YES) and step 2, and a dot omission detection demand flag is set, and when elapsed time t1 is not over the judgment time amount t0, it progresses to (step 1:NO) and step 3. In this case, the judgment time amount t0 is chosen from decision table 61A according to the temperature and humidity which were measured by temperature and the humidity sensor 68, 1 or two or more processings are chosen as arbitration from the processings set as the above-mentioned measurement object, and elapsed time t1 is measured by the timer 61.

[0037] the case where the dot omission detection demand flag is not set at step 3 -- (step 3:NO) -- processing is finished as it is. Moreover, when the dot omission detection demand flag is set, (step 3:YES) and a control section 60 judge first whether it is in the condition which can operate the nozzle detection device 50 (step 4). For example, when a print head 12 is operating, (step 4:NO) and nozzle detection processing are shelved, and when a print head 12 is waiting, it progresses to (step 4:YES) and step 5. In carrying out by repeating nozzle detection processing and cleaning treatment, repeat counter k is initialized at step 5.

[0038] The nozzle detection device 50 is controlled by the nozzle detection processing facility 65, and nozzle detection processing is performed (step 6). And by consequently, the cleaning judgment function 66 The dot omission has not arisen for each nozzle 13, and when it is judged that ink has not adhered around each nozzle 13 on the nozzle side 14, a dot omission detection demand flag is reset, without performing (step 7:NO) and cleaning treatment (step 8), and processing is finished.

[0039] On the other hand, when the dot omission has produced at least one nozzle 13, or when ink has adhered also around one nozzle 13, (step 7:YES), and repeat counter k and the predetermined number of cycles k0 (for example, k0=4) are compared (step 9), and when a predetermined number is not reached, (step 9:NO) and cleaning treatment are performed (step 10). A control section 60 controls the cleaning device 40 by the cleaning treatment function 67, and makes cleaning treatment, such as Flushing or wiping, perform by it. While the thickening ink which carried out blinding within the nozzle 13 is breathed out by this and the reconstitution of the meniscus is carried out, the ink (thickening ink is also included) adhering to a nozzle side is wiped away.

[0040] However, in one cleaning treatment, since a dot omission cannot be canceled and ink can remain to the nozzle side 14, with the gestalt of this operation, a series of processings of nozzle detection (step 6) - cleaning (step 10) are repeated, and are performed. That is, after performing error processing, such as an error message, when a nozzle condition is unusual in addition even if it finishes this processing when counting of the count of processing of this single string is carried out with Counter k and the ink condition of the ink condition [under this repetitive operation and in a nozzle 13] or nozzle side 14 becomes normal, and it carries out [usually / the number of return and predetermined times] to processing (step 12), it usually returns to processing.

[0041] a ***** [that there is blinding within the nozzle condition 13, i.e., a nozzle,

according to the gestalt of this operation as stated above] -- or after detecting whether ink has adhered around a nozzle 13 on the nozzle side 14 (dot omission detection), since it was made to clean and it is not necessary not to clean when a nozzle condition is normal, ink or the time amount which cleaning takes cannot consume vainly, but it can clean efficiently.

[0042] Moreover, an ink condition is detectable to the optimal timing assumed to become a dot omission from having defined the criteria at the time of judging whether a nozzle condition is detected according to change of temperature or humidity under various environments.

[0043] Consequently, since it is not necessary to carry out useless processing when there is no need of cleaning primarily compared with the case where it cleans compulsorily, after progress of a predetermined period like the conventional technique, Since it becomes possible to clean in the phase which other efficient processings other than cleaning (for example, printing processing) can be performed, and the effectiveness of the whole printer can be raised, and thickening ink does not solidify, thickening ink is easily removable.

[0044] Furthermore, although various candidates for a comparison to the criteria at the time of judging whether a nozzle condition is detected were prepared, since it enabled it to choose them from inside as arbitration according to the gestalt of this operation, the optimal detection timing can be set up according to the operating condition of a printer 1.

[0045] According to the gestalt of this operation, a quality of printed character can be certainly maintained further again from it having been made to perform nozzle detection processing and cleaning treatment repeatedly until the nozzle condition became normal.

[0046] Next, the gestalt of other operations of this invention is explained. As shown in drawing 5 , especially decision table 61B used for the gestalt of other operations of this invention is referred to in case destruction of the meniscus accompanying the busy condition of a print head 12 is detected among dot omissions. Under the environment where temperature or humidity changes, the timing by which the viscosity of the part which forms the meniscus increases and this is destroyed changes with busy conditions of a print head 12 like the case of the gestalt of the above-mentioned implementation. Moreover, if there is many use of a print head 12, foreign matters, such as paper powder, will become easy to adhere to the nozzle side 14, and will cause a dot omission. 0 is set up in the shape of a matrix corresponding to temperature T1-T5 and humidity H1-H5 the several judgment use which serves as a criterion at the time of judging whether dot omission detection is performed from a viewpoint which copes with quickly destruction of the meniscus by such ink and a foreign matter that were thickened. As the number of use of the print head 12 as a parameter which specifies the busy condition of a print head 12, there is a count of the regurgitation, the number of printed lines, or printing numbers of passes of a nozzle etc. Decision table 61B shown in drawing 5 is an

example of the detection conditions n0 defined about the number of printed lines, or printing numbers of passes. for example, the detection conditions n0 -- low temperature -- in the bottom [being highly humid ($T1 < 10$ degree C, $80\% \leq H4$)], it is set as 4500 [the number of printed lines (or numbers of passes)] -- having -- an elevated temperature -- in the bottom [being damp ($45 \text{ degree-C} \leq T \text{ four}$, $H1 < 20\%$)], it is set as 1000 [the number of printed lines (or numbers of passes)].

[0047] In using such decision table 61B, a control section 60 is different in respect of the following as compared with the gestalt of above-mentioned operation. That is, about the nozzle detection judgment function 64, when 0 is compared the several n judgment use stored in 1 and decision table 61B the several n use by which counting was carried out with the counter 63 with predetermined processing of a printer 1 as the starting point and 1 is over 0 several n judgment use several n use, a dot omission detection demand flag is set and dot omission detection displays a required purport.

[0048] Moreover, a counter 63 can set to 1 the number of use from an initiation [of predetermined processing], or termination point in time, for example, the number of use from the nozzle detection processing performed to (1) last time, the number of use from the cleaning treatment performed to (2) last time, etc. several n use, and can carry out counting. And the number of use of at least 1 chosen as arbitration among these is used as a candidate for a comparison of 0 several n judgment use.

[0049] furthermore, about the nozzle detection processing and cleaning treatment which a control section 60 performs In step 1, the several n use by which counting was carried out with the counter 63 1, When 0 is compared the several n judgment use chosen from decision table 61B and 1 is over 0 several n judgment use several n use It progresses to step 2, and when a dot omission detection demand flag is set and 1 is not over 0 several n judgment use several n use, it progresses to step 3.

[0050] The timing by which the ink viscosity of the part which forms the meniscus increases in the case of the gestalt of this operation which has such a configuration, and a meniscus is destroyed In the bottom of various environments from having considered as the criteria at the time of judging whether corresponding to change of temperature or humidity, and the busy condition of a print head 12, it sets separately, and a nozzle condition is detected, and an operating condition An ink condition is detectable to the optimal timing assumed to become a dot omission.

[0051] About the other configurations and operation effectiveness, since it is the same as that of the gestalt of the above-mentioned implementation, the detailed explanation is omitted.

[0052] In addition, this invention can make various change, without being restricted to the gestalt of above-mentioned operation. For example, at the power up of a printer, and the time of exchange of an ink cartridge, at the time of reception of printing data or a printing instruction, the nozzle detection processing and cleaning treatment concerning this invention can also be constituted so that it may perform at the time of termination

of printing processing, or after [termination] predetermined period progress of printing processing etc.

[0053] Moreover, in the gestalt of the above-mentioned implementation, although the dot omission was detected using the micro sensor which changes into output voltage a contact condition with the liquid ink drop breathed out by the nozzle detection device from each nozzle, it is also possible to use a pressure sensor and a sway sensor (refer to JP,58-217365,A, publication number No. 33438 [11 to], publication number No. 104535 [11 to], and JP,2000-79679,A). Furthermore, the printing condition of adherend is optically detected [flight of the liquid ink drop from (1) nozzle] for detection and (2) liquid-ink drop by discharge CCD to adherends, such as paper. (3) Detection by the existence of a temperature fall of the adherend (sensor side) by the heat of vaporization of the breathed-out ink, (4) It is also possible to apply detection methods, such as detection by the pressure fluctuation of the pressure room of a print head, detection by the current change at the time of (5) head drives, and detection by the change in resistance of the ink in (6) heads, to the nozzle detection device of this invention. However, it differs from the above-mentioned well-known reference etc. in that the nozzle detection device of this invention is setting not only the ink condition in a nozzle but the ink condition on a nozzle side as the object of detection.

[0054]

[Effect of the Invention] Since it is not necessary by being made to clean after detecting the nozzle condition (ink condition) of a print head to clean according to this invention when the nozzle condition of a print head is normal as stated above, ink or time amount which cleaning takes cannot be consumed vainly, but it can clean efficiently.

[0055] Moreover, since the criterion at the time of judging whether an ink condition is detected was defined according to change of temperature or humidity according to this invention, an ink condition is detectable to the optimal timing assumed to become a dot omission under various environments.

[0056] Furthermore, since it was made according to this invention to choose it from from as arbitration while setting up variously the candidate for a comparison to the criterion of whether to detect an ink condition according to actuation of a printer, the optimal detection timing can be set up according to the operating condition of a printer.

[0057] Furthermore, since according to this invention it was made to perform nozzle detection processing and cleaning treatment repeatedly until the nozzle condition became normal, a quality of printed character is certainly maintainable.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the outline configuration of the printer of the gestalt of this operation.

[Drawing 2] It is the block diagram showing the control system containing the control section of the gestalt of this operation.

[Drawing 3] It is drawing showing the contents of the decision table memorized by the memory contained in this control section.

[Drawing 4] It is the flow chart which shows the flow of the Main processing of the control section of the gestalt of this operation.

[Drawing 5] It is drawing showing the contents on the decision table memorized by the memory contained in the control section of the gestalt of other operations.

[Description of Notations]

40 Cleaning Device

50 Nozzle Detection Device

60 Control Section

61 Memory

61A, 61B Decision table

62 Timer

63 Counter

64 Nozzle Detection Judgment Function

65 Nozzle Detection Processing Facility

66 Cleaning Judgment Function

67 Cleaning Treatment Function